



11206730_1.TXT

SEQUENCE LISTING

<110> BLACK, Margaret E.

<120> THYMIDINE KINASE MUTANTS AND FUSION
PROTEINS HAVING THYMIDINE KINASE AND GUANYLATE KINASE
ACTIVITIES

<130> 60117-4

<140> 09/173,463

<141> 1998-10-14

<150> 60/061,812

<151> 1997-10-14

<160> 172

<170> FastSEQ for Windows Version 4.0

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<211> 1131

<212> DNA

<213> Herpesviridae sp.

<400> 1

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33

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<221> CDS

<222> (1)...(33)

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<223> Primer

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<223> Primer

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<210> 33
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<400> 33
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<210> 36
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<220>
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<210> 46

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5

10

15

Arg Gly Ser Ser Met

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<210> 47

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<213> Herpesviridae sp.

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Tyr Pro Ile

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<213> Homo sapiens

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gct ggg aag agc acc ctg ctg aag agg ctg ctc cag gag cac agc ggc      96
Ala Gly Lys Ser Thr Leu Leu Lys Arg Leu Leu Gln Glu His Ser Gly
 15                      20                      25                      30

atc ttt ggc ttc agc gtg tcc cat acc acg agg aac ccg agg ccc ggc      144
Ile Phe Gly Phe Ser Val Ser His Thr Thr Arg Asn Pro Arg Pro Gly
                      35                      40                      45

gag gag aac ggc aaa gat tac tac ttt gta acc agg gag gtg atg cag      192
Glu Glu Asn Gly Lys Asp Tyr Tyr Phe Val Thr Arg Glu Val Met Gln
                      50                      55                      60

cgt gac ata gca gcc ggc gac ttc atc gag cat gcc gag ttc tcg ggg      240
Arg Asp Ile Ala Ala Gly Asp Phe Ile Glu His Ala Glu Phe Ser Gly
                      65                      70                      75

aac ctg tat ggc acg agc aag gtg gcg gtg cag gcc gtg cag gcc atg      288
Asn Leu Tyr Gly Thr Ser Lys Val Ala Val Gln Ala Val Gln Ala Met
                      80                      85                      90

aac cgc atc tgt gtg ctg gac gtg gac ctg cag ggt gtg cgg aac atc      336
Asn Arg Ile Cys Val Leu Asp Val Asp Leu Gln Gly Val Arg Asn Ile
 95                      100                      105                      110

aag gcc acc gat ctg cgg ccc atc tac atc tct gtg cag ccg cct tca      384
Lys Ala Thr Asp Leu Arg Pro Ile Tyr Ile Ser Val Gln Pro Pro Ser
                      115                      120                      125

ctg cac gtg ctg gag cag cgg ctg cgg cag cgc aac act gaa acc gag      432
Leu His Val Leu Glu Gln Arg Leu Arg Gln Arg Asn Thr Glu Thr Glu
                      130                      135                      140

gag agc ctg gtg aag cgg ctg gct gct gcc cag gcc gac atg gag agc      480
Glu Ser Leu Val Lys Arg Leu Ala Ala Ala Gln Ala Asp Met Glu Ser
                      145                      150                      155

agc aag gag ccc ggc ctg ttt gat gtg gtc atc att aac gac agc ctg      528
Ser Lys Glu Pro Gly Leu Phe Asp Val Val Ile Ile Asn Asp Ser Leu
                      160                      165                      170

gac cag gcc tac gca gag ctg aag gag gcg ctc tct gag gaa atc aag      576
Asp Gln Ala Tyr Ala Glu Leu Lys Glu Ala Leu Ser Glu Glu Ile Lys
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<210> 49

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<213> Homo sapiens

<400> 49

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 35 40 45
 Asn Gly Lys Asp Tyr Tyr Phe Val Thr Arg Glu Val Met Gln Arg Asp
 50 55 60
 Ile Ala Ala Gly Asp Phe Ile Glu His Ala Glu Phe Ser Gly Asn Leu
 65 70 75 80
 Tyr Gly Thr Ser Lys Val Ala Val Gln Ala Val Gln Ala Met Asn Arg
 85 90 95
 Ile Cys Val Leu Asp Val Asp Leu Gln Gly Val Arg Asn Ile Lys Ala
 100 105 110
 Thr Asp Leu Arg Pro Ile Tyr Ile Ser Val Gln Pro Pro Ser Leu His
 115 120 125
 Val Leu Glu Gln Arg Leu Arg Gln Arg Asn Thr Glu Thr Glu Glu Ser
 130 135 140
 Leu Val Lys Arg Leu Ala Ala Ala Gln Ala Asp Met Glu Ser Ser Lys
 145 150 155 160
 Glu Pro Gly Leu Phe Asp Val Val Ile Ile Asn Asp Ser Leu Asp Gln
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 Gln Arg Thr Gly Ala
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 Ser Gly Pro Ser Gly Ala Gly Lys Ser Thr Leu Leu Lys Lys Leu Phe
 10 15 20 25
 cag gag cac agc agc atc ttc ggc ttc agt gtg tcc cat act aca agg 147
 Gln Glu His Ser Ser Ile Phe Gly Phe Ser Val Ser His Thr Thr Arg
 30 35 40
 aac cca cga cct ggt gaa gaa gat ggc aaa gat tac tac ttt gtg acc 195
 Asn Pro Arg Pro Gly Glu Glu Asp Gly Lys Asp Tyr Tyr Phe Val Thr
 45 50 55
 agg gag atg atg cag cgt gat att gca gca ggg gac ttc att gag cat 243
 Arg Glu Met Met Gln Arg Asp Ile Ala Ala Gly Asp Phe Ile Glu His
 60 65 70
 gct gag ttc tca ggg aac ctg tac ggg aca agc aag gaa gct gtt cgg 291
 Ala Glu Phe Ser Gly Asn Leu Tyr Gly Thr Ser Lys Glu Ala Val Arg
 75 80 85
 gct gtg cag gcc atg aac cgc atc tgc gtg cta gat gtc gac cta caa 339
 Ala Val Gln Ala Met Asn Arg Ile Cys Val Leu Asp Val Asp Leu Gln
 90 95 100 105

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ggt gtg cgc agc atc aag aag act gat ctg tgt ccc atc tac atc ttt 387
 Gly Val Arg Ser Ile Lys Lys Thr Asp Leu Cys Pro Ile Tyr Ile Phe
 110 115 120
 gtg cag cct ccc tcg ctg gac gtg ctg gag caa cga ctg cga ctg cgc 435
 Val Gln Pro Pro Ser Leu Asp Val Leu Glu Gln Arg Leu Arg Leu Arg
 125 130 135
 aac act gag act gag gag agt ctg gca aag cgg ctg gca gct gca cgg 483
 Asn Thr Glu Thr Glu Glu Ser Leu Ala Lys Arg Leu Ala Ala Ala Arg
 140 145 150
 aca gac atg gag agc agc aag gag cct ggc ttg ttt gac ctg gtg atc 531
 Thr Asp Met Glu Ser Ser Lys Glu Pro Gly Leu Phe Asp Leu Val Ile
 155 160 165
 atc aat gac gac ctg gat aaa gcc tat gca acc ctg aag cag gcg ctc 579
 Ile Asn Asp Asp Leu Asp Lys Ala Tyr Ala Thr Leu Lys Gln Ala Leu
 170 175 180 185
 tct gag gaa atc aag aaa gca cag gga act ggc cac gcc tgaaggcctg 628
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 35 40 45
 Asp Gly Lys Asp Tyr Tyr Phe Val Thr Arg Glu Met Met Gln Arg Asp
 50 55 60
 Ile Ala Ala Gly Asp Phe Ile Glu His Ala Glu Phe Ser Gly Asn Leu
 65 70 75 80
 Tyr Gly Thr Ser Lys Glu Ala Val Arg Ala Val Gln Ala Met Asn Arg
 85 90 95
 Ile Cys Val Leu Asp Val Asp Leu Gln Gly Val Arg Ser Ile Lys Lys
 100 105 110
 Thr Asp Leu Cys Pro Ile Tyr Ile Phe Val Gln Pro Pro Ser Leu Asp
 115 120 125
 Val Leu Glu Gln Arg Leu Arg Leu Arg Asn Thr Glu Thr Glu Glu Ser
 130 135 140
 Leu Ala Lys Arg Leu Ala Ala Ala Arg Thr Asp Met Glu Ser Ser Lys
 145 150 155 160
 Glu Pro Gly Leu Phe Asp Leu Val Ile Ile Asn Asp Asp Leu Asp Lys
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 Ala Tyr Ala Thr Leu Lys Gln Ala Leu Ser Glu Glu Ile Lys Lys Ala
 180 185 190
 Gln Gly Thr Gly His Ala
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 ctttgctacc cg 72

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<223> HSVTK Mutant

<400> 68

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tgttgctacc cg 72

<210> 69

<211> 69

<212> DNA

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 69

tcacatgccc cgccccccct caccctcgta ttagaccgtc atcccatcgc ctactatcta 60
tgctaccct 69

<210> 70

<211> 69

<212> DNA

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 70

tcacatgccc cgccggccct cacctgtttt ctcgaccgcc atcccatcgc ctattatctt 60
tgctaccgc 69

<210> 71

<211> 15

<212> PRT

<213> Herpesviridae sp.

<400> 71

Leu Ile Phe Asp Arg His Pro Ile Ala Ala Leu Leu Cys Tyr Pro
1 5 10 15

<210> 72
 <211> 15
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> HSVTK Mutant

<400> 72
 Leu Val Phe Asp Arg His Pro Ile Ala Thr Leu Leu Cys Tyr Pro
 1 5 10 15

<210> 73
 <211> 15
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> HSVTK Mutant

<400> 73
 Phe Ile Phe Asp Arg His Pro Ile Ala Tyr Tyr Ile Cys Tyr Pro
 1 5 10 15

<210> 74
 <211> 15
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> HSVTK Mutant

<400> 74
 Val Leu Ser Asp Arg His Pro Ile Ala Arg Ile Tyr Cys Tyr Pro
 1 5 10 15

<210> 75
 <211> 15
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> HSVTK Mutant

<400> 75
 Leu Ile Leu Asp Arg His Pro Ile Ala Asn Phe Ile Cys Tyr Pro
 1 5 10 15

<210> 76
 <211> 15
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> HSVTK Mutant

<400> 76

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Thr Phe Tyr Asp Arg His Pro Ile Ala Trp Met Phe Cys Tyr Pro
 1 5 10 15

<210> 77

<211> 15

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 77

Val Val Cys Asp Arg His Pro Ile Ala Cys Thr Leu Cys Tyr Pro
 1 5 10 15

<210> 78

<211> 15

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 78

Leu Phe Ala Asp Arg His Pro Ile Ala Thr Leu Leu Cys Tyr Pro
 1 5 10 15

<210> 79

<211> 15

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 79

Val Phe Ser Asp Arg His Pro Ile Ala Leu Leu Leu Cys Tyr Pro
 1 5 10 15

<210> 80

<211> 15

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 80

Leu Cys Phe Asp Arg His Pro Ile Ala Tyr Cys Ile Cys Tyr Pro
 1 5 10 15

<210> 81

<211> 15

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

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<400> 81

Ile Ile Ala Asp Arg His Pro Ile Ala Leu Leu Val Cys Tyr Pro
1 5 10 15

<210> 82

<211> 15

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 82

Leu Ile Leu Asp Arg His Pro Ile Ala Val Ser Leu Cys Tyr Pro
1 5 10 15

<210> 83

<211> 15

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 83

Leu Leu His Asp Arg His Pro Ile Ala Val Cys Val Cys Tyr Pro
1 5 10 15

<210> 84

<211> 15

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 84

Leu Leu Ser Asp Arg His Pro Ile Ala Tyr His Leu Cys Tyr Pro
1 5 10 15

<210> 85

<211> 15

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 85

Phe Leu Val Asp Arg His Pro Ile Ala Trp Asn Leu Cys Tyr Pro
1 5 10 15

<210> 86

<211> 15

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 86

Thr	Val	Phe	Asp	Arg	His	Pro	Ile	Ala	Ser	Thr	Phe	Cys	Tyr	Pro
1				5					10					15

<210> 87

<211> 15

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 87

Leu	Thr	Phe	Asp	Arg	His	Pro	Ile	Ala	Gly	Thr	Leu	Cys	Tyr	Pro
1				5					10					15

<210> 88

<211> 15

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 88

Leu	Phe	Ile	Asp	Arg	His	Pro	Ile	Ala	Thr	Ile	Leu	Cys	Tyr	Pro
1				5					10					15

<210> 89

<211> 15

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 89

Val	Ala	Ala	Asp	Arg	His	Pro	Ile	Ala	Phe	Ser	Tyr	Cys	Tyr	Pro
1				5					10					15

<210> 90

<211> 15

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 90

Pro	Thr	Gln	Asp	Arg	His	Pro	Ile	Ala	Ser	Asp	Pro	Cys	Tyr	Pro
1				5					10					15

<210> 91

<211> 15

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 91

Arg Ala Phe Asp Arg His Pro Ile Gly Gln Thr Ser Cys Tyr Pro
1 5 10 15

<210> 92

<211> 15

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 92

Asp Gly Val Asp Arg His Pro Ile Ala Cys Arg His Cys Tyr Pro
1 5 10 15

<210> 93

<211> 15

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 93

Asp Asn Asn Asp Arg His Pro Ile Ala Gln Ser Pro Cys Tyr Pro
1 5 10 15

<210> 94

<211> 11

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 94

Ile Leu Asn Asp Arg His Pro Ile Ala Arg Thr
1 5 10

<210> 95

<211> 15

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 95

Phe Leu Asp Asp Arg His Pro Ile Ala Pro Leu Leu Cys Tyr Pro
1 5 10 15

<210> 96

<211> 15
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> HSVTK Mutant

<400> 96
 Tyr Tyr Val Asp Arg His Pro Ile Ala Val Ser Leu Cys Tyr Pro
 1 5 10 15

<210> 97
 <211> 12
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> HSVTK Mutant

<400> 97
 Asp Arg His Pro Ile Ala Leu Arg Ser Cys Asn Pro
 1 5 10

<210> 98
 <211> 15
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> HSVTK Mutant

<400> 98
 Leu Asn Pro Asp Arg His Pro Ile Ala Cys Asp Cys Cys Tyr Pro
 1 5 10 15

<210> 99
 <211> 12
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> HSVTK Mutant

<400> 99
 Ser Trp Gly Asp Arg His Pro Ile Glu Lys Phe Ile
 1 5 10

<210> 100
 <211> 15
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> HSVTK Mutant

<400> 100
 Tyr Gly Ser Asp Arg His Pro Ile Ala Ile Cys Pro Cys Tyr Pro
 1 5 10 15

<210> 101
 <211> 8
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> HSVTK Mutant

<400> 101
 Asp Arg His Pro Ile Ala Ile Ile
 1 5

<210> 102
 <211> 15
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> HSVTK Mutant

<400> 102
 Tyr Tyr Asn Asp Arg His Pro Ile Ala Gly Ser Pro Cys Tyr Pro
 1 5 10 15

<210> 103
 <211> 15
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> HSVTK Mutant

<400> 103
 Trp Gly Arg Asp Arg His Pro Ile Ala Asn Leu Leu Cys Tyr Pro
 1 5 10 15

<210> 104
 <211> 15
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> HSVTK Mutant

<400> 104
 Arg Leu Pro Asp Arg His Pro Ile Ala Asn Glu Ala Cys Tyr Pro
 1 5 10 15

<210> 105
 <211> 12
 <212> PRT
 <213> Herpesviridae sp.

<400> 105
 Leu Ile Phe Asp Arg His Pro Ile Ala Ala Leu Leu
 1 5 10

<210> 106
<211> 12
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 106
Leu Phe Leu Asp Arg His Pro Ile Ala Phe Asn Leu
1 5 10

<210> 107
<211> 12
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 107
Leu Phe Ala Asp Arg His Pro Ile Ala Phe Leu Leu
1 5 10

<210> 108
<211> 12
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 108
Ile Phe Leu Asp Arg His Pro Ile Ala Phe Met Leu
1 5 10

<210> 109
<211> 12
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 109
Ile Leu Leu Asp Arg His Pro Ile Ala Tyr Leu Leu
1 5 10

<210> 110
<211> 12
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 110
Leu Phe Ala Asp Arg His Pro Ile Ala Tyr Tyr Leu
1 5 10

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<210> 111
 <211> 12
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> HSVTK Mutant

<400> 111
 Leu Phe Val Asp Arg His Pro Ile Ala Val Met Leu
 1 5 10

<210> 112
 <211> 12
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> HSVTK Mutant

<400> 112
 Ile Phe Val Asp Arg His Pro Ile Ala Phe Tyr Leu
 1 5 10

<210> 113
 <211> 21
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Primer

<400> 113
 gtctcggagg cgcccagcac c 21

<210> 114
 <211> 59
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Oligonucleotide used to generate TK mutants

<400> 114
 aggctgggag ctacatgcc ccgcccccg ccctcaccac tcttgcgct cgaccgcca 59

<210> 115
 <211> 54
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Oligonucleotide used to generate TK mutants

<400> 115
 ataaggtacc gcgcggccgg gtagcacaga catgtacagg cgatgggatg gcgg 54

<210> 116
 <211> 55

<212> DNA
 <213> Artificial Sequence

<220>
 <223> Oligonucleotide used to generate TK mutants

<400> 116
 cgcctcgacc agggtagat atcggccggg gacgcggcgg tggtaatgac aagcg 55

<210> 117
 <211> 58
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Oligonucleotide used to generate TK mutants

<400> 117
 gaacggcgtc gggtcacggca taaggcatgc ccattgttat ctgggcgctt gtcattac 58

<210> 118
 <211> 60
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Oligonucleotide used to generate TK mutants

<400> 118
 ggcgcctccg agacaatcgc gaacatctac accacacaac accgcctcga ccagggtgag 60

<210> 119
 <211> 59
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Oligonucleotide used to generate TK mutants

<400> 119
 tcgactgagc tcccagcctc ccccccgata tgaggagcca gaacggcgtc gggtcacggc 59

<210> 120
 <211> 24
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Oligonucleotide used to generate TK mutants

<400> 120
 gcagctggcg cctccgagac aatc 24

<210> 121
 <211> 19
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> Oligonucleotide used to generate TK mutants

<400> 121

tcgactgagc tcccagcct

<210> 122

<211> 24

<212> PRT

<213> Artificial Sequence

<220>

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<400> 122

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1				5					10					15	
Ile	Ala	Tyr	Phe	Leu	Cys	Tyr	Pro								
			20												

<210> 123

<211> 24

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 123

Ser	His	Ala	Pro	Pro	Pro	Ala	Leu	Thr	Val	Ile	Thr	Asp	Arg	His	Pro
1				5					10					15	
Ile	Ala	Cys	Leu	Leu	Cys	Tyr	Pro								
			20												

<210> 124

<211> 24

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 124

Ser	His	Ala	Pro	Pro	Pro	Ala	Leu	Thr	Leu	Leu	Leu	Asp	Arg	His	Pro
1				5					10					15	
Ile	Ala	Val	Met	Leu	Cys	Tyr	Pro								
			20												

<210> 125

<211> 24

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 125

Ser	His	Ala	Pro	Pro	Pro	Ala	Leu	Thr	Leu	Ile	Leu	Asp	Arg	His	Pro
1				5					10					15	
Ile	Ala	Ser	Tyr	Cys	Cys	Tyr	Pro								
			20												

<210> 126

<211> 24
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> HSVTK Mutant

<400> 126
 Ser His Ala Pro Pro Pro Ala Leu Thr Met Phe Met Asp Arg His Pro
 1 5 10 15
 Ile Ala His Asn Val Cys Tyr Pro
 20

<210> 127
 <211> 24
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> HSVTK Mutant

<400> 127
 Ser His Ala Pro Pro Pro Ala Leu Thr Ile Leu Leu Asp Arg His Pro
 1 5 10 15
 Ile Ala Ile Tyr Leu Cys Tyr Pro
 20

<210> 128
 <211> 24
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> HSVTK Mutant

<400> 128
 Ser His Ala Pro Pro Pro Ala Leu Thr Phe Tyr Tyr Asp Arg His Pro
 1 5 10 15
 Ile Ala Pro Phe Val Cys Tyr Pro
 20

<210> 129
 <211> 24
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> HSVTK Mutant

<400> 129
 Ser His Ala Pro Pro Pro Ala Leu Thr Leu Phe Leu Asp Arg His Pro
 1 5 10 15
 Ile Ala Leu Met Cys Cys Tyr Pro
 20

<210> 130
 <211> 24
 <212> PRT
 <213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 130

Ser His Ala Pro Pro Pro Ala Leu Thr Leu Val Leu Asp Arg His Pro
 1 5 10 15
 Ile Ala Tyr Tyr Leu Cys Tyr Pro
 20

<210> 131

<211> 24

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 131

Ser His Ala Pro Pro Pro Ala Leu Thr Cys Phe Leu Asp Arg His Pro
 1 5 10 15
 Ile Ala Tyr Tyr Leu Cys Tyr Pro
 20

<210> 132

<211> 24

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<220>

<221> VARIANT

<222> 10

<223> Xaa = Ile OR Leu

<220>

<221> VARIANT

<222> 11

<223> Xaa = Ile OR Leu OR Phe

<220>

<221> VARIANT

<222> 12

<223> Xaa = Phe OR Ala OR Val OR Pro OR Leu

<220>

<221> VARIANT

<222> 19

<223> Xaa = Ala OR Asp OR Tyr OR Val OR Phe

<220>

<221> VARIANT

<222> 20

<223> Xaa = Leu OR Phe OR Tyr OR Ile OR Met OR Asn OR
Lys

<400> 132

Ser His Ala Pro Pro Pro Ala Leu Thr Xaa Xaa Xaa Asp Arg His Pro

1 5
Ile Ala Xaa Xaa Leu Cys Tyr Pro
20

10

15

<210> 133
<211> 11
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<220>
<221> VARIANT
<222> 1
<223> Xaa = Ile OR Leu

<220>
<221> VARIANT
<222> 2
<223> Xaa = Ile OR Leu OR Phe

<220>
<221> VARIANT
<222> 3
<223> Xaa = Phe OR Ala OR Val OR Pro OR Leu

<220>
<221> VARIANT
<222> 10
<223> Xaa = Ala OR Asp OR Tyr OR Val OR Phe

<220>
<221> VARIANT
<222> 11
<223> Xaa = Leu OR Phe OR Tyr OR Ile OR Met OR Asn OR
Lys

<400> 133
Xaa Xaa Xaa Asp Arg His Pro Ile Ala Xaa Xaa
1 5 10

<210> 134
<211> 376
<212> PRT
<213> Herpesviridae sp.

<400> 134
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
1 5 10 15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
20 25 30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
35 40 45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
50 55 60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65 70 75 80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
85 90 95

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Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
100 105 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
115 120 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
130 135 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145 150 155 160
Phe Asp Arg His Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
165 170 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
180 185 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
195 200 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
210 215 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225 230 235 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
245 250 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
260 265 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
275 280 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
290 295 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305 310 315 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
325 330 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
340 345 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
355 360 365
Ala Arg Glu Met Gly Glu Ala Asn
370 375

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<210> 135

<211> 376

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 135

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Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
1 5 10 15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
20 25 30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
35 40 45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
50 55 60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65 70 75 80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
85 90 95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
100 105 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
115 120 125

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Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
 130 135 140
 Gly Glu Ala Gly Ser Ser His Val Pro Pro Pro Ala Leu Thr Ile Leu
 145 150 155 160
 Ala Asp Arg His Pro Ile Ala Tyr Phe Leu Cys Tyr Pro Ala Ala Arg
 165 170 175
 Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
 180 185 190
 Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
 195 200 205
 Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
 210 215 220
 Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
 225 230 235 240
 Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
 245 250 255
 Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
 260 265 270
 Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
 275 280 285
 Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
 290 295 300
 Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
 305 310 315 320
 Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
 325 330 335
 Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
 340 345 350
 Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
 355 360 365
 Ala Arg Glu Met Gly Glu Ala Asn
 370 375

<210> 136

<211> 376

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 136

Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1 5 10 15
 Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
 20 25 30
 Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
 35 40 45
 Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
 50 55 60
 Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
 65 70 75 80
 Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
 85 90 95
 Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
 100 105 110
 Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
 115 120 125
 Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
 130 135 140
 Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ser Leu Thr Leu Ile
 145 150 155 160

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Leu Asp Arg His Pro Ile Ala Ser Tyr Cys Cys Tyr Pro Ala Ala Arg
165 170 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
180 185 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
195 200 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
210 215 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225 230 235 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
245 250 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
260 265 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
275 280 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
290 295 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305 310 315 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
325 330 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
340 345 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
355 360 365
Ala Arg Glu Met Gly Glu Ala Asn
370 375

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<210> 137

<211> 374

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 137

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Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
1 5 10 15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
20 25 30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
35 40 45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
50 55 60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65 70 75 80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
85 90 95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
100 105 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
115 120 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
130 135 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Leu Thr Ile Leu Leu Asp
145 150 155 160
Arg His Pro Ile Ala Ile Tyr Leu Cys Tyr Pro Ala Ala Arg Tyr Leu
165 170 175
Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala Leu Ile
180 185 190

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Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu Pro Glu
195 200 205
Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly Glu Arg
210 215 220
Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly Leu Leu
225 230 235 240
Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg Glu Asp
245 250 255
Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala Glu Pro
260 265 270
Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu Phe Thr
275 280 285
Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu Tyr Asn
290 295 300
Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg Ser Met
305 310 315 320
His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys Arg Asp
325 330 335
Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val Thr Thr
340 345 350
Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe Ala Arg
355 360 365
Glu Met Gly Glu Ala Asn
370

```

<210> 138

<211> 375

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 138

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Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
1 5 10 15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
20 25 30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
35 40 45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
50 55 60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65 70 75 80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
85 90 95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
100 105 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
115 120 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
130 135 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Ala Leu Thr Phe Tyr Tyr
145 150 155 160
Asp Arg His Pro Ile Ala Pro Phe Val Cys Tyr Pro Ala Ala Arg Tyr
165 170 175
Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala Leu
180 185 190
Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu Pro
195 200 205
Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly Glu
210 215 220

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Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly Leu
225      230      235      240
Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg Glu
      245      250      255
Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala Glu
      260      265      270
Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu Phe
      275      280      285
Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu Tyr
      290      295      300
Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg Ser
305      310      315      320
Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys Arg
      325      330      335
Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val Thr
      340      345      350
Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe Ala
      355      360      365
Arg Glu Met Gly Glu Ala Asn
370      375

```

<210> 139

<211> 375

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 139

```

Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
1      5      10      15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
      20      25      30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
      35      40      45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
      50      55      60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
      65      70      75      80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
      85      90      95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
      100      105      110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
      115      120      125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
      130      135      140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Leu Thr Leu Val Leu
145      150      155      160
Asp Arg His Pro Ile Ala Tyr Tyr Leu Cys Tyr Pro Ala Ala Arg Tyr
      165      170      175
Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala Leu
      180      185      190
Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu Pro
      195      200      205
Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly Glu
      210      215      220
Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly Leu
225      230      235      240
Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg Glu
      245      250      255

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Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala Glu
 260 265 270
 Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu Phe
 275 280 285
 Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu Tyr
 290 295 300
 Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg Ser
 305 310 315 320
 Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys Arg
 325 330 335
 Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val Thr
 340 345 350
 Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe Ala
 355 360 365
 Arg Glu Met Gly Glu Ala Asn
 370 375

<210> 140

<211> 375

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 140

Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1 5 10 15
 Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
 20 25 30
 Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
 35 40 45
 Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
 50 55 60
 Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
 65 70 75 80
 Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
 85 90 95
 Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
 100 105 110
 Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
 115 120 125
 Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
 130 135 140
 Gly Glu Ala Gly Ser Ser His Ala Pro Pro Ala Leu Thr Cys Phe Leu
 145 150 155 160
 Asp Arg His Pro Ile Ala Tyr Tyr Leu Cys Tyr Pro Ala Ala Arg Tyr
 165 170 175
 Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala Leu
 180 185 190
 Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu Pro
 195 200 205
 Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly Glu
 210 215 220
 Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly Leu
 225 230 235 240
 Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg Glu
 245 250 255
 Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala Glu
 260 265 270
 Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu Phe
 275 280 285

11206730_1.TXT

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Thr  Leu  Phe  Arg  Ala  Pro  Glu  Leu  Leu  Ala  Pro  Asn  Gly  Asp  Leu  Tyr
290      295      300
Asn  Val  Phe  Ala  Trp  Ala  Leu  Asp  Val  Leu  Ala  Lys  Arg  Leu  Arg  Ser
305      310      315      320
Met  His  Val  Phe  Ile  Leu  Asp  Tyr  Asp  Gln  Ser  Pro  Ala  Gly  Cys  Arg
      325      330      335
Asp  Ala  Leu  Leu  Gln  Leu  Thr  Ser  Gly  Met  Val  Gln  Thr  His  Val  Thr
      340      345      350
Thr  Pro  Gly  Ser  Ile  Pro  Thr  Ile  Cys  Asp  Leu  Ala  Arg  Thr  Phe  Ala
      355      360      365
Arg  Glu  Met  Gly  Glu  Ala  Asn
      370      375

```

<210> 141

<211> 376

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 141

```

Met  Ala  Ser  Tyr  Pro  Gly  His  Gln  His  Ala  Ser  Ala  Phe  Asp  Gln  Ala
1      5      10      15
Ala  Arg  Ser  Arg  Gly  His  Ser  Asn  Arg  Arg  Thr  Ala  Leu  Arg  Pro  Arg
      20      25      30
Arg  Gln  Gln  Glu  Ala  Thr  Glu  Val  Arg  Leu  Glu  Gln  Lys  Met  Pro  Thr
      35      40      45
Leu  Leu  Arg  Val  Tyr  Ile  Asp  Gly  Pro  His  Gly  Met  Gly  Lys  Thr  Thr
      50      55      60
Thr  Thr  Gln  Leu  Leu  Val  Ala  Leu  Gly  Ser  Arg  Asp  Asp  Ile  Val  Tyr
65      70      75      80
Val  Pro  Glu  Pro  Met  Thr  Tyr  Trp  Gln  Val  Leu  Gly  Ala  Ser  Glu  Thr
      85      90      95
Ile  Ala  Asn  Ile  Tyr  Thr  Thr  Gln  His  Arg  Leu  Asp  Gln  Gly  Glu  Ile
      100      105      110
Ser  Ala  Gly  Asp  Ala  Ala  Val  Val  Met  Thr  Ser  Ala  Gln  Ile  Thr  Met
      115      120      125
Gly  Met  Pro  Tyr  Ala  Val  Thr  Asp  Ala  Val  Leu  Ala  Pro  His  Ile  Gly
      130      135      140
Gly  Glu  Ala  Gly  Ser  Ser  His  Ala  Pro  Pro  Ala  Ala  Leu  Thr  Leu  Ile
145      150      155      160
Val  Asp  Arg  His  Pro  Ile  Ala  Ala  Leu  Leu  Cys  Tyr  Pro  Ala  Ala  Arg
      165      170      175
Tyr  Leu  Met  Gly  Ser  Met  Thr  Pro  Gln  Ala  Val  Leu  Ala  Phe  Val  Ala
      180      185      190
Leu  Ile  Pro  Pro  Thr  Leu  Pro  Gly  Thr  Asn  Ile  Val  Leu  Gly  Ala  Leu
      195      200      205
Pro  Glu  Asp  Arg  His  Ile  Asp  Arg  Leu  Ala  Lys  Arg  Gln  Arg  Pro  Gly
      210      215      220
Glu  Arg  Leu  Asp  Leu  Ala  Met  Leu  Ala  Ala  Ile  Arg  Arg  Val  Tyr  Gly
225      230      235      240
Leu  Leu  Ala  Asn  Thr  Val  Arg  Tyr  Leu  Gln  Cys  Gly  Gly  Ser  Trp  Arg
      245      250      255
Glu  Asp  Trp  Gly  Gln  Leu  Ser  Gly  Thr  Ala  Val  Pro  Pro  Gln  Gly  Ala
      260      265      270
Glu  Pro  Gln  Ser  Asn  Ala  Gly  Pro  Arg  Pro  His  Ile  Gly  Asp  Thr  Leu
      275      280      285
Phe  Thr  Leu  Phe  Arg  Ala  Pro  Glu  Leu  Leu  Ala  Pro  Asn  Gly  Asp  Leu
290      295      300
Tyr  Asn  Val  Phe  Ala  Trp  Ala  Leu  Asp  Val  Leu  Ala  Lys  Arg  Leu  Arg
305      310      315      320

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Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
 325 330 335
 Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
 340 345 350
 Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
 355 360 365
 Ala Arg Glu Met Gly Glu Ala Asn
 370 375

<210> 142

<211> 376

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 142

Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1 5 10 15
 Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
 20 25 30
 Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
 35 40 45
 Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
 50 55 60
 Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
 65 70 75 80
 Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
 85 90 95
 Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
 100 105 110
 Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
 115 120 125
 Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
 130 135 140
 Gly Glu Ala Gly Ser Ser His Ala Pro Pro Gln Ala Leu Thr Leu Ile
 145 150 155 160
 Ile Asp Arg His Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
 165 170 175
 Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
 180 185 190
 Leu Ile Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
 195 200 205
 Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
 210 215 220
 Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
 225 230 235 240
 Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
 245 250 255
 Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
 260 265 270
 Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
 275 280 285
 Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
 290 295 300
 Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
 305 310 315 320
 Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
 325 330 335
 Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
 340 345 350

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Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
 355 360 365
 Ala Arg Glu Met Gly Glu Ala Asn
 370 375

<210> 143

<211> 376

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 143

Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1 5 10 15
 Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
 20 25 30
 Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
 35 40 45
 Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
 50 55 60
 Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
 65 70 75 80
 Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
 85 90 95
 Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
 100 105 110
 Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
 115 120 125
 Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
 130 135 140
 Gly Glu Ala Gly Ser Ser His Ala Pro Pro Gln Ala Leu Thr Leu Ile
 145 150 155 160
 Phe Glu Arg His Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
 165 170 175
 Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
 180 185 190
 Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
 195 200 205
 Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
 210 215 220
 Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
 225 230 235 240
 Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
 245 250 255
 Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
 260 265 270
 Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
 275 280 285
 Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
 290 295 300
 Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
 305 310 315 320
 Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
 325 330 335
 Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
 340 345 350
 Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
 355 360 365
 Ala Arg Glu Met Gly Glu Ala Asn
 370 375

<210> 144
 <211> 376
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> HSVTK Mutant

<400> 144

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Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1      5      10      15
Ala Arg Ser Arg Gly His Ser Asn Arg Thr Ala Leu Arg Pro Arg
 20      25      30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
 35      40      45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
 50      55      60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
 65      70      75      80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
 85      90      95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
 100     105     110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
 115     120     125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
 130     135     140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Arg Ala Leu Thr Leu Ile
 145     150     155     160
Phe Glu Arg His Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
 165     170     175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
 180     185     190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
 195     200     205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
 210     215     220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
 225     230     235     240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
 245     250     255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
 260     265     270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
 275     280     285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
 290     295     300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
 305     310     315     320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
 325     330     335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
 340     345     350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
 355     360     365
Ala Arg Glu Met Gly Glu Ala Asn
 370     375

```

<210> 145
 <211> 376

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 145

```

Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1      5      10      15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
      20      25      30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
      35      40      45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
      50      55      60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65      70      75      80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
      85      90      95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
      100      105      110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
      115      120      125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
      130      135      140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Arg Ala Leu Thr Leu Ile
145      150      155      160
Phe Gly Arg His Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
      165      170      175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
      180      185      190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
      195      200      205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
      210      215      220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225      230      235      240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
      245      250      255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
      260      265      270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
      275      280      285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
      290      295      300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305      310      315      320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
      325      330      335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
      340      345      350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
      355      360      365
Ala Arg Glu Met Gly Glu Ala Asn
      370      375

```

<210> 146

<211> 376

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 146

```

Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1      5      10      15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
 20      25      30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
 35      40      45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
 50      55      60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
 65      70      75
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
 85      90      95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
100      105      110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
115      120      125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
130      135      140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Thr Ala Leu Thr Leu Ile
145      150      155
Phe Glu Arg His Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
165      170      175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
180      185      190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
195      200      205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
210      215      220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225      230      235
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
245      250      255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
260      265      270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
275      280      285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
290      295      300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305      310      315
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
325      330      335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
340      345      350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
355      360      365
Ala Arg Glu Met Gly Glu Ala Asn
370      375

```

<210> 147

<211> 376

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 147

```

Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala

```

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```

1      5      10      15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
20      25      30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
35      40      45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
50      55      60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65      70      75      80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
85      90      95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
100      105      110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
115      120      125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
130      135      140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145      150      155      160
Ile Asp His His Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
165      170      175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
180      185      190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
195      200      205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
210      215      220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225      230      235      240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
245      250      255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
260      265      270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
275      280      285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
290      295      300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305      310      315      320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
325      330      335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
340      345      350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
355      360      365
Ala Arg Glu Met Gly Glu Ala Asn
370      375

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<210> 148

<211> 376

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 148

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Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
1      5      10      15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
20      25      30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr

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      35      40      45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
 50 55 60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65 70 75 80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
 85 90 95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
100 105 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
115 120 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
130 135 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145 150 155 160
Ile Asp Arg His Arg Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
165 170 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
180 185 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
195 200 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
210 215 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225 230 235 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
245 250 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
260 265 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
275 280 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
290 295 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305 310 315 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
325 330 335
Arg Asp Ala Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
340 345 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
355 360 365
Ala Arg Glu Met Gly Glu Ala Asn
370 375

```

<210> 149

<211> 376

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 149

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Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1 5 10 15
Ala Arg Ser Arg Gly His Ser Asn Arg Thr Ala Leu Arg Pro Arg
20 25 30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
35 40 45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
50 55 60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr

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65      70      75      80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
      85      90      95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
      100      105      110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
      115      120      125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
      130      135      140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
      145      150      155
Asn Asp Arg His Ser Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
      160      165      170
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
      180      185      190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
      195      200      205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
      210      215      220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
      225      230      235
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
      240      245      250
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
      255      260      265
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
      270      275      280
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
      285      290      295
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
      300      305      310
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
      315      320      325
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
      330      335      340
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
      345      350      355
Ala Arg Glu Met Gly Glu Ala Asn
      360      365      370

```

<210> 150

<211> 376

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 150

```

Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
1      5      10      15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
      20      25      30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
      35      40      45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
      50      55      60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
      65      70      75      80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
      85      90      95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile

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      100      105      110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
      115      120      125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
      130      135      140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145      150      155      160
Phe Tyr Cys His Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
      165      170      175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
      180      185      190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
      195      200      205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
      210      215      220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225      230      235      240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
      245      250      255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
      260      265      270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
      275      280      285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
290      295      300      305
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305      310      315      320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
      325      330      335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
      340      345      350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
      355      360      365
Ala Arg Glu Met Gly Glu Ala Asn
370      375

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<210> 151

<211> 376

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 151

```

Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
1      5      10      15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
      20      25      30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
      35      40      45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
      50      55      60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65      70      75      80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
      85      90      95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
      100      105      110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
      115      120      125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly

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      130      135      140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145 150 155 160
Phe Asn Arg Lys Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
      165 170 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
      180 185 190
Leu Ile Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
      195 200 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
      210 215 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225 230 235 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
      245 250 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
      260 265 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
      275 280 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
      290 295 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305 310 315 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
      325 330 335
Arg Asp Ala Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
      340 345 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
      355 360 365
Ala Arg Glu Met Gly Glu Ala Asn
      370      375

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<210> 152

<211> 376

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 152

```

Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
1 5 10 15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
      20 25 30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
      35 40 45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
      50 55 60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65 70 75 80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
      85 90 95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
      100 105 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
      115 120 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
      130 135 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145 150 155 160
Phe Glu Arg Asn Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg

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165      170      175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
180      185      190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
195      200      205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
210      215      220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225      230      235
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
245      250      255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
260      265      270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
275      280      285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
290      295      300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305      310      315
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
325      330      335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
340      345      350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
355      360      365
Ala Arg Glu Met Gly Glu Ala Asn
370      375

```

<210> 153

<211> 376

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 153

```

Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
1      5      10      15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
20      25      30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
35      40      45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
50      55      60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65      70      75
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
85      90      95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
100      105      110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
115      120      125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
130      135      140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145      150      155
Phe Asp Pro Gln Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
165      170      175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
180      185      190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu

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Pro	Glu	195	Asp	Arg	His	Ile	Asp	200	Arg	Leu	Ala	Lys	Arg	205	Gln	Arg	Pro	Gly
	210						215						220					
Glu	Arg	Leu	Asp	Leu	Ala	Met	Leu	Ala	Ala	Ile	Arg	Arg	Val	Tyr	Gly			
225					230					235					240			
Leu	Leu	Ala	Asn	Thr	Val	Arg	Tyr	Leu	Gln	Cys	Gly	Gly	Ser	Trp	Arg			
			245						250					255				
Glu	Asp	Trp	Gly	Gln	Leu	Ser	Gly	Thr	Ala	Val	Pro	Pro	Gln	Gly	Ala			
		260						265					270					
Glu	Pro	Gln	Ser	Asn	Ala	Gly	Pro	Arg	Pro	His	Ile	Gly	Asp	Thr	Leu			
	275						280					285						
Phe	Thr	Leu	Phe	Arg	Ala	Pro	Glu	Leu	Leu	Ala	Pro	Asn	Gly	Asp	Leu			
	290					295					300							
Tyr	Asn	Val	Phe	Ala	Trp	Ala	Leu	Asp	Val	Leu	Ala	Lys	Arg	Leu	Arg			
305					310					315					320			
Ser	Met	His	Val	Phe	Ile	Leu	Asp	Tyr	Asp	Gln	Ser	Pro	Ala	Gly	Cys			
			325						330					335				
Arg	Asp	Ala	Leu	Gln	Leu	Thr	Ser	Gly	Met	Val	Gln	Thr	His	Val				
		340					345					350						
Thr	Thr	Pro	Gly	Ser	Ile	Pro	Thr	Ile	Cys	Asp	Leu	Ala	Arg	Thr	Phe			
	355					360						365						
Ala	Arg	Glu	Met	Gly	Glu	Ala	Asn											
370					375													

<210> 154
 <211> 376
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> HSVTK Mutant

<400>	154																	
Met	Ala	Ser	Tyr	Pro	Gly	His	Gln	His	Ala	Ser	Ala	Phe	Asp	Gln	Ala			
1				5				10					15					
Ala	Arg	Ser	Arg	Gly	His	Ser	Asn	Arg	Thr	Ala	Leu	Arg	Pro	Arg				
			20				25					30						
Arg	Gln	Gln	Glu	Ala	Thr	Glu	Val	Arg	Leu	Glu	Gln	Lys	Met	Pro	Thr			
		35				40					45							
Leu	Leu	Arg	Val	Tyr	Ile	Asp	Gly	Pro	His	Gly	Met	Gly	Lys	Thr	Thr			
	50				55			60										
Thr	Thr	Gln	Leu	Leu	Val	Ala	Leu	Gly	Ser	Arg	Asp	Asp	Ile	Val	Tyr			
65					70			75						80				
Val	Pro	Glu	Pro	Met	Thr	Tyr	Trp	Gln	Val	Leu	Gly	Ala	Ser	Glu	Thr			
			85				90						95					
Ile	Ala	Asn	Ile	Tyr	Thr	Thr	Gln	His	Arg	Leu	Asp	Gln	Gly	Glu	Ile			
		100					105					110						
Ser	Ala	Gly	Asp	Ala	Ala	Val	Val	Met	Thr	Ser	Ala	Gln	Ile	Thr	Met			
	115					120						125						
Gly	Met	Pro	Tyr	Ala	Val	Thr	Asp	Ala	Val	Leu	Ala	Pro	His	Ile	Gly			
	130					135				140								
Gly	Glu	Ala	Gly	Ser	Ser	His	Ala	Pro	Pro	Pro	Ala	Leu	Thr	Leu	Ile			
145				150				155						160				
Phe	Asp	Arg	Gln	Leu	Ile	Ala	Ala	Leu	Leu	Cys	Tyr	Pro	Ala	Ala	Arg			
			165					170					175					
Tyr	Leu	Met	Gly	Ser	Met	Thr	Pro	Gln	Ala	Val	Leu	Ala	Phe	Val	Ala			
		180					185					190						
Leu	Ile	Pro	Pro	Thr	Leu	Pro	Gly	Thr	Asn	Ile	Val	Leu	Gly	Ala	Leu			
	195					200						205						
Pro	Glu	Asp	Arg	His	Ile	Asp	Arg	Leu	Ala	Lys	Arg	Gln	Arg	Pro	Gly			
	210					215					220							
Glu	Arg	Leu	Asp	Leu	Ala	Met	Leu	Ala	Ala	Ile	Arg	Arg	Val	Tyr	Gly			

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225      230      235      240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
      245      250      255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
      260      265      270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
      275      280      285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
      290      295      300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305      310      315      320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
      325      330      335
Arg Asp Ala Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
      340      345      350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
      355      360      365
Ala Arg Glu Met Gly Glu Ala Asn
370      375

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<210> 155

<211> 376

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 155

```

Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
1      5      10      15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
      20      25      30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
      35      40      45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
      50      55      60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65      70      75      80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
      85      90      95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
      100      105      110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
      115      120      125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
      130      135      140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Gln Ala Leu Thr Leu Ile
145      150      155      160
Phe Glu Arg His Leu Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
      165      170      175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
      180      185      190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
      195      200      205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
      210      215      220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225      230      235      240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
      245      250      255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala

```

			260					265				270			
Glu	Pro	Gln	Ser	Asn	Ala	Gly	Pro	Arg	Pro	His	Ile	Gly	Asp	Thr	Leu
		275					280					285			
Phe	Thr	Leu	Phe	Arg	Ala	Pro	Glu	Leu	Leu	Ala	Pro	Asn	Gly	Asp	Leu
		290				295					300				
Tyr	Asn	Val	Phe	Ala	Trp	Ala	Leu	Asp	Val	Leu	Ala	Lys	Arg	Leu	Arg
305					310					315					320
Ser	Met	His	Val	Phe	Ile	Leu	Asp	Tyr	Asp	Gln	Ser	Pro	Ala	Gly	Cys
				325					330					335	
Arg	Asp	Ala	Leu	Leu	Gln	Leu	Thr	Ser	Gly	Met	Val	Gln	Thr	His	Val
			340					345					350		
Thr	Thr	Pro	Gly	Ser	Ile	Pro	Thr	Ile	Cys	Asp	Leu	Ala	Arg	Thr	Phe
		355					360					365			
Ala	Arg	Glu	Met	Gly	Glu	Ala	Asn								
	370					375									

<213> Artificial Sequence

<223> HSVTK Mutant

Met 1	Ala 2	Ser 3	Tyr 4	Pro 5	Gly 6	His 7	Gln 8	His 9	Ala 10	Ser 11	Ala 12	Phe 13	Asp 14	Gln 15	Ala 16
Ala 17	Arg 18	Ser 19	Arg 20	Gly 21	His 22	Ser 23	Asn 24	Arg 25	Arg 26	Thr 27	Ala 28	Leu 29	Arg 30	Pro 31	Arg 32
Arg 33	Gln 34	Gln 35	Glu 36	Ala 37	Thr 38	Glu 39	Val 40	Arg 41	Leu 42	Glu 43	Gln 44	Lys 45	Met 46	Pro 47	Thr 48
Leu 49	Leu 50	Arg 51	Val 52	Tyr 53	Ile 54	Asp 55	Gly 56	Pro 57	His 58	Gly 59	Met 60	Gly 61	Lys 62	Thr 63	Thr 64
Thr 65	Thr 66	Gln 67	Leu 68	Leu 69	Val 70	Ala 71	Leu 72	Gly 73	Ser 74	Arg 75	Asp 76	Asp 77	Ile 78	Val 79	Tyr 80
Val 81	Pro 82	Glu 83	Pro 84	Met 85	Thr 86	Tyr 87	Trp 88	Gln 89	Val 90	Leu 91	Gly 92	Ala 93	Ser 94	Glu 95	Thr 96
Ile 97	Ala 98	Asn 99	Ile 100	Tyr 101	Thr 102	Thr 103	Gln 104	His 105	Arg 106	Leu 107	Asp 108	Gln 109	Gly 110	Glu 111	Ile 112
Ser 113	Ala 114	Gly 115	Asp 116	Ala 117	Ala 118	Val 119	Val 120	Met 121	Thr 122	Ser 123	Ala 124	Gln 125	Ile 126	Thr 127	Met 128
Gly 129	Met 130	Pro 131	Tyr 132	Ala 133	Val 134	Thr 135	Asp 136	Ala 137	Val 138	Leu 139	Ala 140	Pro 141	His 142	Ile 143	Gly 144
Gly 145	Glu 146	Ala 147	Gly 148	Ser 149	Ser 150	His 151	Ala 152	Pro 153	Pro 154	Ala 155	Ala 156	Leu 157	Thr 158	Leu 159	Ile 160
Phe 161	Asp 162	Pro 163	His 164	Thr 165	Ile 166	Ala 167	Ala 168	Leu 169	Leu 170	Cys 171	Tyr 172	Pro 173	Ala 174	Ala 175	Arg 176
Tyr 177	Leu 178	Met 179	Gly 180	Ser 181	Met 182	Thr 183	Pro 184	Gln 185	Ala 186	Val 187	Leu 188	Ala 189	Phe 190	Val 191	Ala 192
Leu 193	Ile 194	Pro 195	Pro 196	Thr 197	Leu 198	Pro 199	Gly 200	Thr 201	Asn 202	Ile 203	Val 204	Leu 205	Gly 206	Ala 207	Leu 208
Pro 209	Glu 210	Asp 211	Arg 212	His 213	Ile 214	Asp 215	Arg 216	Leu 217	Ala 218	Lys 219	Arg 220	Gln 221	Arg 222	Pro 223	Gly 224
Glu 225	Arg 226	Leu 227	Asp 228	Leu 229	Ala 230	Met 231	Leu 232	Ala 233	Ala 234	Ile 235	Arg 236	Arg 237	Val 238	Tyr 239	Gly 240
Leu 241	Leu 242	Ala 243	Asn 244	Thr 245	Val 246	Arg 247	Tyr 248	Leu 249	Gln 250	Cys 251	Gly 252	Gly 253	Ser 254	Trp 255	Arg 256
Glu 257	Asp 258	Trp 259	Gly 260	Gln 261	Leu 262	Ser 263	Gly 264	Thr 265	Ala 266	Val 267	Pro 268	Pro 269	Gln 270	Gly 271	Ala 272
Glu 273	Pro 274	Gln 275	Ser 276	Asn 277	Ala 278	Gly 279	Pro 280	Arg 281	Pro 282	His 283	Ile 284	Gly 285	Asp 286	Thr 287	Leu 288
Phe 289	Thr 290	Leu 291	Phe 292	Arg 293	Ala 294	Pro 295	Glu 296	Leu 297	Leu 298	Ala 299	Pro 300	Asn 301	Gly 302	Asp 303	Leu 304

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290		295		300
Tyr Asn Val Phe Ala Trp	Ala Leu Asp Val Leu Ala Lys Arg Leu Arg			
305	310	315	320	
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys				
	325	330	335	
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val				
	340	345	350	
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe				
	355	360	365	
Ala Arg Glu Met Gly Glu Ala Asn				
370	375			

<210> 157

<211> 376

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 157

Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala	
1	5
Ala Arg Ser Arg Gly His Ser Asn Arg Thr Ala Leu Arg Pro Arg	
	20
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr	
	35
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr	
	50
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr	
65	70
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr	
	85
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile	
	100
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met	
	115
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly	
	130
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile	
145	150
Phe Asn Ser Asn Ala Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg	
	165
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala	
	180
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu	
	195
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly	
	210
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly	
225	230
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg	
	245
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala	
	260
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu	
	275
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu	
	290
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg	
305	310
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys	
	315

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Arg	Asp	Ala	Leu	325	Gln	Leu	Thr	Ser	330	Gly	Met	Val	Gln	Thr	335	His	Val
Thr	Thr	Pro	Gly	340	Ser	Ile	Pro	Thr	345	Ile	Cys	Asp	Leu	Ala	350	Arg	Thr
Ala	Arg	Glu	Met	355	Gly	Glu	Ala	Asn	360					365			
			370				375										

<210> 158
 <211> 376
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> HSVTK Mutant

Met	Ala	Ser	Tyr	Pro	Gly	His	Gln	His	Ala	Ser	Ala	Phe	Asp	Gln	Ala
1				5					10					15	
Ala	Arg	Ser	Arg	Gly	His	Ser	Asn	Arg	Arg	Thr	Ala	Leu	Arg	Pro	Arg
			20					25					30		
Arg	Gln	Gln	Glu	Ala	Thr	Glu	Val	Arg	Leu	Glu	Gln	Lys	Met	Pro	Thr
		35					40					45			
Leu	Leu	Arg	Val	Tyr	Ile	Asp	Gly	Pro	His	Gly	Met	Gly	Lys	Thr	Thr
	50					55					60				
Thr	Thr	Gln	Leu	Leu	Val	Ala	Leu	Gly	Ser	Arg	Asp	Asp	Ile	Val	Tyr
65					70					75				80	
Val	Pro	Glu	Pro	Met	Thr	Tyr	Trp	Gln	Val	Leu	Gly	Ala	Ser	Glu	Thr
				85					90					95	
Ile	Ala	Asn	Ile	Tyr	Thr	Thr	Gln	His	Arg	Leu	Asp	Gln	Gly	Glu	Ile
			100					105					110		
Ser	Ala	Gly	Asp	Ala	Ala	Val	Val	Met	Thr	Ser	Ala	Gln	Ile	Thr	Met
		115					120					125			
Gly	Met	Pro	Tyr	Ala	Val	Thr	Asp	Ala	Val	Leu	Ala	Pro	His	Ile	Gly
	130					135					140				
Gly	Glu	Ala	Gly	Ser	Ser	His	Ala	Pro	Pro	Ala	Ala	Leu	Thr	Leu	Ile
145					150					155					160
Cys	Asp	Arg	His	Pro	Ile	Ala	Ala	Leu	Leu	Cys	Tyr	Pro	Ala	Ala	Arg
				165					170					175	
Tyr	Leu	Met	Gly	Ser	Met	Thr	Pro	Gln	Ala	Val	Leu	Ala	Phe	Val	Ala
		180						185					190		
Leu	Ile	Pro	Pro	Thr	Leu	Pro	Gly	Thr	Asn	Ile	Val	Leu	Gly	Ala	Leu
		195					200						205		
Pro	Glu	Asp	Arg	His	Ile	Asp	Arg	Leu	Ala	Lys	Arg	Gln	Arg	Pro	Gly
	210					215						220			
Glu	Arg	Leu	Asp	Leu	Ala	Met	Leu	Ala	Ala	Ile	Arg	Arg	Val	Tyr	Gly
225					230					235					240
Leu	Leu	Ala	Asn	Thr	Val	Arg	Tyr	Leu	Gln	Cys	Gly	Gly	Ser	Trp	Arg
			245						250					255	
Glu	Asp	Trp	Gly	Gln	Leu	Ser	Gly	Thr	Ala	Val	Pro	Pro	Gln	Gly	Ala
		260						265					270		
Glu	Pro	Gln	Ser	Asn	Ala	Gly	Pro	Arg	Pro	His	Ile	Gly	Asp	Thr	Leu
		275					280					285			
Phe	Thr	Leu	Phe	Arg	Ala	Pro	Glu	Leu	Leu	Ala	Pro	Asn	Gly	Asp	Leu
	290					295					300				
Tyr	Asn	Val	Phe	Ala	Trp	Ala	Leu	Asp	Val	Leu	Ala	Lys	Arg	Leu	Arg
305					310					315					320
Ser	Met	His	Val	Phe	Ile	Leu	Asp	Tyr	Asp	Gln	Ser	Pro	Ala	Gly	Cys
				325					330					335	
Arg	Asp	Ala	Leu	Gln	Leu	Thr	Ser	Gly	Met	Val	Gln	Thr	His	Val	
			340				345						350		
Thr	Thr	Pro	Gly	Ser	Ile	Pro	Thr	Ile	Cys	Asp	Leu	Ala	Arg	Thr	Phe

Ala Arg 355 Glu Met Gly Glu Ala Asn 360
370 375

<210> 159
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 159
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
1 5 10 15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
20 25 30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
35 40 45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
50 55 60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65 70 75 80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
85 90 95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
100 105 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
115 120 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
130 135 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Ala Ala Leu Thr Leu Ile
145 150 155 160
Phe Glu Arg His Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
165 170 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
180 185 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
195 200 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
210 215 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225 230 235 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
245 250 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
260 265 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
275 280 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
290 295 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305 310 315 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
325 330 335
Arg Asp Ala Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
340 345 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
355 360 365
Ala Arg Glu Met Gly Glu Ala Asn
370 375

<210> 160
 <211> 376
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> HSVTK Mutant

<400> 160
 Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1 5 10 15
 Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
 20 25 30
 Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
 35 40 45
 Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
 50 55 60
 Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
 65 70 75 80
 Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
 85 90 95
 Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
 100 105 110
 Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
 115 120 125
 Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
 130 135 140
 Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Leu
 145 150 155 160
 Leu Asp Arg His Pro Ile Ala Val Met Leu Cys Tyr Pro Ala Ala Arg
 165 170 175
 Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
 180 185 190
 Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
 195 200 205
 Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
 210 215 220
 Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
 225 230 235 240
 Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
 245 250 255
 Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
 260 265 270
 Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
 275 280 285
 Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
 290 295 300
 Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
 305 310 315 320
 Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
 325 330 335
 Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
 340 345 350
 Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
 355 360 365
 Ala Arg Glu Met Gly Glu Ala Asn
 370 375

<210> 161
 <211> 376
 <212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 161

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Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
1      5      10      15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
20      25      30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
35      40      45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
50      55      60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65      70      75      80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
85      90      95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
100     105     110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
115     120     125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
130     135     140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145     150     155     160
Leu Asp Arg His Pro Ile Ala Val Tyr Cys Cys Tyr Pro Ala Ala Arg
165     170     175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
180     185     190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
195     200     205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
210     215     220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225     230     235     240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
245     250     255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
260     265     270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
275     280     285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
290     295     300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305     310     315     320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
325     330     335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
340     345     350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
355     360     365
Ala Arg Glu Met Gly Glu Ala Asn
370     375

```

<210> 162

<211> 376

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

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<400> 162

```

Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1      5      10      15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
 20      25      30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
 35      40      45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
 50      55      60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
 65      70      75
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
 85      90      95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
100      105      110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
115      120      125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
130      135      140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145      150      155
Ile Asp Arg His Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
165      170      175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
180      185      190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
195      200      205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
210      215      220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225      230      235
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
245      250      255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
260      265      270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
275      280      285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
290      295      300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305      310      315
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
325      330      335
Arg Asp Ala Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
340      345      350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
355      360      365
Ala Arg Glu Met Gly Glu Ala Asn
370      375

```

<210> 163

<211> 376

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 163

```

Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1      5      10      15

```

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Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
 20 25 30
 Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
 35 40 45
 Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
 50 55 60
 Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
 65 70 75 80
 Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
 85 90 95
 Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
 100 105 110
 Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
 115 120 125
 Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
 130 135 140
 Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
 145 150 155 160
 Cys Asp Arg His Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
 165 170 175
 Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
 180 185 190
 Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
 195 200 205
 Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
 210 215 220
 Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
 225 230 235 240
 Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
 245 250 255
 Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
 260 265 270
 Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
 275 280 285
 Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
 290 295 300
 Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
 305 310 315 320
 Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
 325 330 335
 Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
 340 345 350
 Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
 355 360 365
 Ala Arg Glu Met Gly Glu Ala Asn
 370 375

<210> 164

<211> 376

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 164

Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1 5 10 15
 Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
 20 25 30
 Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
 35 40 45

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```

Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
 50      55      60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65      70      75      80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
      85      90      95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
      100      105      110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
      115      120      125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
      130      135      140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145      150      155      160
Leu Asp Arg His Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
      165      170      175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
      180      185      190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
      195      200      205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
      210      215      220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225      230      235      240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
      245      250      255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
      260      265      270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
      275      280      285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
      290      295      300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305      310      315      320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
      325      330      335
Arg Asp Ala Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
      340      345      350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
      355      360      365
Ala Arg Glu Met Gly Glu Ala Asn
      370      375

```

<210> 165

<211> 376

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 165

```

Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1      5      10      15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
      20      25      30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
      35      40      45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
      50      55      60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65      70      75      80

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```

Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
      85      90      95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
      100      105      110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
      115      120      125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
      130      135      140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
      145      150      155      160
Phe Asp Arg His Pro Ile Ser Ala Leu Leu Cys Tyr Pro Ala Ala Arg
      165      170      175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
      180      185      190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
      195      200      205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
      210      215      220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
      225      230      235      240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
      245      250      255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
      260      265      270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
      275      280      285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
      290      295      300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
      305      310      315      320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
      325      330      335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
      340      345      350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
      355      360      365
Ala Arg Glu Met Gly Glu Ala Asn
      370      375

```

<210> 166

<211> 376

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 166

```

Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
  1      5      10      15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
      20      25      30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
      35      40      45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
      50      55      60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
      65      70      75      80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
      85      90      95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
      100      105      110

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Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
 115 120 125
 Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
 130 135 140
 Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
 145 150 155 160
 Phe Asp Arg His Pro Ile Ser Ala Leu Leu Cys Tyr Pro Val Ala Arg
 165 170 175
 Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
 180 185 190
 Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
 195 200 205
 Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
 210 215 220
 Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
 225 230 235 240
 Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
 245 250 255
 Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
 260 265 270
 Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
 275 280 285
 Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
 290 295 300
 Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
 305 310 315 320
 Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
 325 330 335
 Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
 340 345 350
 Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
 355 360 365
 Ala Arg Glu Met Gly Glu Ala Asn
 370 375

<210> 167

<211> 376

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 167

Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1 5 10 15
 Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
 20 25 30
 Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
 35 40 45
 Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
 50 55 60
 Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
 65 70 75 80
 Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
 85 90 95
 Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
 100 105 110
 Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
 115 120 125
 Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
 130 135 140

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Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
 145 150 155 160
 Phe Asp Arg His Ala Ile Ala Ala Leu Leu Cys Tyr Pro Val Ala Arg
 165 170 175
 Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
 180 185 190
 Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
 195 200 205
 Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
 210 215 220
 Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
 225 230 235 240
 Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
 245 250 255
 Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
 260 265 270
 Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
 275 280 285
 Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
 290 295 300
 Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
 305 310 315 320
 Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
 325 330 335
 Arg Asp Ala Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
 340 345 350
 Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
 355 360 365
 Ala Arg Glu Met Gly Glu Ala Asn
 370 375

<210> 168

<211> 376

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 168

Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1 5 10 15
 Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
 20 25 30
 Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
 35 40 45
 Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
 50 55 60
 Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
 65 70 75 80
 Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
 85 90 95
 Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
 100 105 110
 Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
 115 120 125
 Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
 130 135 140
 Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
 145 150 155 160
 Phe Gly Arg His Ala Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
 165 170 175

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Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
180 185 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
195 200 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
210 215 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225 230 235 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
245 250 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
260 265 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
275 280 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
290 295 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305 310 315 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
325 330 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
340 345 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
355 360 365
Ala Arg Glu Met Gly Glu Ala Asn
370 375

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<210> 169

<211> 376

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 169

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Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
1 5 10 15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
20 25 30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
35 40 45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
50 55 60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65 70 75 80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
85 90 95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
100 105 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
115 120 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
130 135 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145 150 155 160
Phe Glu Arg His Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
165 170 175 180
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
180 185 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
195 200 205

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Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
 210      215      220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225      230      235      240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
      245      250      255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
      260      265      270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
      275      280      285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
      290      295      300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305      310      315      320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
      325      330      335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
      340      345      350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
      355      360      365
Ala Arg Glu Met Gly Glu Ala Asn
      370      375

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<210> 170

<211> 376

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 170

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Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1      5      10      15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
      20      25      30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
      35      40      45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
      50      55      60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65      70      75      80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
      85      90      95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
      100      105      110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
      115      120      125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
      130      135      140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145      150      155      160
Phe Asp Pro His Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
      165      170      175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
      180      185      190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
      195      200      205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
      210      215      220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225      230      235      240

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Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
 245 250 255
 Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
 260 265 270
 Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
 275 280 285
 Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
 290 295 300
 Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
 305 310 315 320
 Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
 325 330 335
 Arg Asp Ala Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
 340 345 350
 Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
 355 360 365
 Ala Arg Glu Met Gly Glu Ala Asn
 370 375

<210> 171

<211> 376

<212> PRT

<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 171

Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1 5 10 15
 Ala Arg Ser Arg Gly His Ser Asn Arg Thr Ala Leu Arg Pro Arg
 20 25 30
 Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
 35 40 45
 Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
 50 55 60
 Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
 65 70 75 80
 Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
 85 90 95
 Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
 100 105 110
 Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
 115 120 125
 Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
 130 135 140
 Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
 145 150 155 160
 Phe Asp Arg Gln Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
 165 170 175
 Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
 180 185 190
 Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
 195 200 205
 Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
 210 215 220
 Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
 225 230 235 240
 Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
 245 250 255
 Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
 260 265 270

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Glu	Pro	Gln	Ser	Asn	Ala	Gly	Pro	Arg	Pro	His	Ile	Gly	Asp	Thr	Leu
		275					280					285			
Phe	Thr	Leu	Phe	Arg	Ala	Pro	Glu	Leu	Leu	Ala	Pro	Asn	Gly	Asp	Leu
		290				295					300				
Tyr	Asn	Val	Phe	Ala	Trp	Ala	Leu	Asp	Val	Leu	Ala	Lys	Arg	Leu	Arg
305					310					315					320
Ser	Met	His	Val	Phe	Ile	Leu	Asp	Tyr	Asp	Gln	Ser	Pro	Ala	Gly	Cys
				325					330					335	
Arg	Asp	Ala	Leu	Leu	Gln	Leu	Thr	Ser	Gly	Met	Val	Gln	Thr	His	Val
			340					345					350		
Thr	Thr	Pro	Gly	Ser	Ile	Pro	Thr	Ile	Cys	Asp	Leu	Ala	Arg	Thr	Phe
		355					360					365			
Ala	Arg	Glu	Met	Gly	Glu	Ala	Asn								
	370					375									

<210> 172

<211> 21

<212> DNA

<213> Artificial Sequence

<220>

<223> Primer

<400> 172

gtctcggagg cgcccagcac c

21